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Subject: Bark Beetle Activity on the Alpine RD (alpinerd)

To: District Ranger, Alpine RD, Apache-Sitgreaves NFs

Chris Hill and Monica Boehning requested the Arizona Zone Forest Health Protection (FHP) staff assess developed recreation sites for bark beetle activity on the Alpine RD. I evaluated bark beetle activity in the Alpine vicinity and developed recreation sites on the Alpine RD on the August 23rd and 25th 2004. I describe in this report what bark beetle activity was observed in these recreation sites, review silvicultural treatments to reduce stand susceptibility, and make recommendations to minimize bark beetle impacts at these sites. More extensive descriptions of bark beetle biology and actions to prevent and suppress bark beetle impacts were described in an earlier report sent to the Alpine RD on September 4, 2002.

Bark beetle activity in developed recreation sites on the Alpine RD

Trees growing in developed recreation sites are often stressed due to repeated damage caused by campers and soil compaction caused by roads and large vehicles parked off-road. During periods of drought or below-average precipitation, such as has been occurring over the last few years, these trees can become extremely stressed. This is further exacerbated by the relatively high density of trees growing in and adjacent to some of the campgrounds. When trees are growing at high densities, there is more inter-tree competition for limited resources, such as light, water, and nutrients (Kolb et al., 1998). The combined effect of these factors is thought to lower production of defensive compounds by the trees and, consequently, increase susceptibility to bark beetle attack.

Thirteen developed recreation sites on the Alpine RD were surveyed for bark beetle activity (**Table 1**). My survey consisted of walkthroughs looking for fading trees, pitch tubes, and boring dust. Relatively low levels of bark beetle activity were found at all recreation sites. The most beetle activity in terms of total trees killed was observed at the largest recreation site – Luna CG. The survey at Luna CG included the main camping area, group areas A, B, and C, and areas surrounding the boat rental facility and dam. Fifteen currently infested trees were observed and more than 80 ponderosa pines were attacked previous to 2004 or early in 2004 and beetles had already emerged from trees at the time of my survey. Of the 15 current infested pine at Luna, only three were trees larger than 12 inches DBH. The smaller infested pine had evidence of pine engraver beetles and larger trees were attacked by a combination of pine engraver beetles, roundheaded pine beetle and western pine beetle.

At the remaining recreation sites located in ponderosa pine and/or mixed conifer zones, the campgrounds higher in elevation had a combination of roundheaded pine beetle and



Douglas-fir beetle activity, while lower elevation campgrounds had primarily roundheaded pine beetle and/or pine engraver beetle activity. Trees attacked by roundheaded pine beetle showed a characteristic bottom up fading pattern (**Figure 1**) compared to pine engraver beetle-attacked trees that typically fade initially top down. Because of the 2004 Three Forks Fire, ongoing drought, and relatively dense stand conditions of mixed conifers, moderate levels of mixed conifer species (true fir and Douglas-fir) were observed in the vicinity of Diamond Rock CG. At the highest elevation recreations sites, such as KP Cienega, spruce beetle and western balsam bark beetle were active at relatively low levels, but had killed several trees in years previous to 2004 (**Figure 2**).

It is important to note that a more intensive survey may find additional infested trees and additional trees may have become infested after my survey was completed. Therefore, the numbers of infested trees reported here should not be considered absolute.

Table 1. Summary of bark beetle activity in recreation sites on Alpine Ranger District, August 2004.

Recreation site	Previously infested pine	Current infested pine	Previously infested fir, spruce or Douglas-fir	Current infested fir, spruce or Douglas-fir
Luna Lake CG	82	15	0	0
Alpine Divide CG	5	2	0	0
Diamond Rock CG	5	0	16	9
Aspen CG	0	0	6	0
Deer Creek CG	1	8	6	0
Raccoon CG	0	0	0	0
Horse Springs/Porcupine CG	5	7	0	0
Horse Springs/Polecat CG	3	3	0	0
Buffalo Crossing CG	0	4	0	0
West Fork Black River CG	3	0	0	0
Hannagan CG	3	1	16	3
KP Cienega CG ¹	0	0	9	2
Upper Blue CG	0	0	0	0
Blue Crossing CG	0	0	0	0

¹One corkbark fir attacked by western balsam bark beetle and one spruce by spruce beetle.





Figure 1. *Ponderosa pine attacked by roundheaded pine beetle. Note bottom-up fading pattern of crown.*



Figure 2. *Spruce beetle-killed Engelmann spruce adjacent to picnic table at KP Cienega CG.*

Silvicultural treatments for reducing bark beetle susceptibility

Management of bark beetle populations falls under two broad categories: direct action against the beetles themselves (suppression) or indirect action that addresses the general stand conditions (prevention). Direct action deals with the symptoms, too many beetles in one place at one time, and is aimed at directly reducing the number of beetles present. Indirect action focuses on the cause of the problem, which relates to optimal stand conditions for beetle buildup and outbreak. The only effective long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large areas and constant monitoring for areas of beetle buildup.

Silvicultural treatments can increase tree vigor and reduce stand susceptibility to beetle attack through reducing basal area or controlling other stand conditions such as species composition and tree size. They are preventive treatments that should be completed prior to stands experiencing beetle outbreaks. Stand hazard rating for *Dendroctonus* bark beetles of ponderosa pine involves measures of tree size, stand or group density (basal area), and the percent of host trees within the stand. In general, ponderosa pine stands that have an average DBH greater than 12 inches and a basal greater than 120 ft²/acre are considered at high risk to bark beetle attack (Schmid et al., 1994; Chojnacky, et al., 2000; Negrón, et al., 2000). Because of the more xeric conditions in the Southwest compared to other western states that have ponderosa pine, the low risk category may be even less than 80 ft²/acre. No stand hazard rating models have been developed for pine engraver beetles species attacking ponderosa pine, primarily because beetle populations are driven by drought and factors leading to large amounts of slash.

Although no stand hazard rating system has been developed for bark beetles attacking ponderosa pine in the White Mountains, Munson and Anhold (1995) developed the following stand hazard rating system for mountain pine beetle in ponderosa pine (table below modified from Chojnacky et al., 2000). This hazard rating system was validated across several sites including the North Kaibab in Arizona.

<u>% PP</u>		<u>Ave. PP DBH</u>		<u>Basal Area (ft²/ac)</u>		<u>Composite Stand Hazard Values</u>	<u>Hazard Rating</u>
>85	(3)	>12	(3)	>120	(3)	8 – 9	High
50-85	(2)	8-12	(2)	80-120	(2)	5 – 7	Moderate
<50	(1)	<8	(1)	<80	(1)	3 – 4	Low

In addition, for prevention of western pine beetle attacks in California, thinning of dense, 70- to 80-year-old sawtimber stands is an effective silvicultural method for managers of both small and large holdings (DeMars and Roettgering, 1982). Demars and Roettgering (1982) state that by reducing stand stocking to 55 to 70 percent of the basal area needed for full site utilization will relieve the competitive stress among the residual trees, improve their vigor, and make them less prone to successful bark beetle attack.

If a thinning project is undertaken, careful management of the slash is required while beetle populations are high and in areas of poor site quality (Parker, 1991). In general, population increases of pine engraver beetle can be minimized by implementing thinning projects after the onset of the monsoon season through December. Cutting trees during this season will allow the material to partially dry out before beetles fly in the spring. Standing residual trees may also be less susceptible during this time due to increased soil moisture caused by the monsoon rains. Slash generated from January through May typically remains moist enough for brood production when beetles begin flying in early April and therefore may enhance beetle population increases. While this is a good general recommendation when beetle populations are relatively low, we have observed pine engraver beetles to complete at least one generation in slash generated during the fall of 2002 and 2003 on most Forests in Arizona. If this timing approach is being used, and trees are only lopped and left on untreated on the site, there are a couple points to consider. First, slash generated on more exposed areas that have relatively low residual basal area will likely dry out more by the time beetles fly in the spring. Second, on steeper slopes or where the residual basal area is still relatively high, slash may not adequately dry out by the time beetles fly in the spring.

Another general “rule of thumb” approach to preventing pine engraver beetles from impacting areas where thinning projects are being implemented is to separate project areas either in time and/or in space. Beetle populations probably will remain relatively low if thinning projects are conducted every other year. Similarly, a buffer of over two miles between management sites is also thought to prevent mass movement of beetles from one area to another. If thinning treatments are implemented in consecutive years, there likely will be a build up of pine engraver beetles that can move from one thinning project to the next.

The best preventive strategy to minimize pine engraver beetle activity related with thinning projects and associated slash is to utilize the larger diameter slash. Harvesting most



ponderosa pine slash larger than 4 inches in diameter will help to prevent beetle populations increases because few beetles are produced in slash less than 4 inches. This smaller diameter material dries out quicker and there can be more competition for less food. The larger diameter slash should be removed from the site or treated (chipped) within 28 days of being generated if thinning occurs during active beetle flight periods (April through early October). If thinning occurs during November through March, the larger diameter material should be removed or treated before the time beetles complete their first generation in the spring (i.e., by early May). If slash does become infested in April, removing or treating the newly infested material may aid in reducing the local population of pine engraver beetles.

Recommendations

Because of the relatively low bark beetle activity within the recreation sites surveyed, I do not recommend using preventative sprays for protecting high value trees at this time. However, based on the current stand conditions, trees within several of the campgrounds are susceptible to beetle attack now and will be in the future unless stand conditions change. In the short-term, prompt removal of currently infested trees will help to reduce the immediate local population of beetles. Trees at Deer Creek CG and Horse Springs CG that were currently infested by roundheaded pine beetle were typically found directly adjacent to trees infested the previous year. Therefore, prompt removal of these currently infested trees will likely help prevent future losses during the existing conditions of relatively low bark beetle activity. It is recommended that the infested trees be removed yet this fall before the brood completes their development and adult beetles emerge. Felling of infested trees will not kill developing brood; infested trees must either be removed from the site or treated on site.

Because these bark beetles are very common and widespread, removal of infested trees is not a guarantee of protection. Therefore, this approach is generally recommended in combination with the long-term preventive approach. Based on the dense stand conditions and relatively low beetle activity at Alpine Divide CG, I recommend that the District pursue thinning at this small recreation site. Thinning is currently being completed adjacent to the campground and reducing stand density within the campground should significantly reduce the short- and long-term stand susceptibility in this area.

As indicated in **Table 1** and **Figure 2**, there are many older dead trees in most of the recreation sites. These trees should be considered as potential hazards that could cause damage when they fall. A thorough inspection of these recreation sites for hazard trees is warranted. Our office can assist in training personnel to conduct hazard tree surveys.



Forest Health Protection Funds for FY2005 may be available for bark beetle prevention and suppression in recreation sites within the Alpine RD. Requests for these funds should be submitted by October 15, 2004. If you have any questions regarding my assessment of current bark beetle activity within the recreation sites or my recommendations, please let me know. I can be reached at (928) 556-2074.

/s/ Joel D. Mcmillin
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cc: Monica Boehning, Chris Hill, John Anhold, Leonard Lucero, Debra Allen-Reid, Deb Bumpus



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